Executive Summary

Remedial Action Plan for the Former Small Arms Range (SAR1) Travis Air Force Base, California

INTRODUCTION

At many Air Force installations there are abandoned small arms firing ranges with metals-contaminated soil. Traditionally, these sites are part of a costly and time-consuming multiphase investigation program that includes a remedial investigation (RI), baseline risk assessment, feasibility study (FS), and remedial design.

This remedial action plan is a partial product of a nationwide Air Force initiative to develop a technically sound, cost effective approach to mitigate this metals contamination (primarily lead) so that human health and the environment are protected. This approach was tested at the former small arms range (SAR1), a West/Annexes/Basewide Operable Unit (WABOU) site that is located in the southwest corner of Travis Air Force Base (AFB). The WABOU is part of the Travis AFB Installation Restoration Program (IRP). The Air Force established the IRP to identify the nature and extent of contamination from past activities, evaluate the risks posed to human health and the environment, and select and implement the most appropriate cleanup options to reduce the risks. More detailed information on the WABOU and the former small arms range is found in the WABOU RI report, the WABOU FS report and the WABOU Soil Proposed Plan. These documents are available for public review in the Travis AFB Information Repository at the Vacaville Public Library.

This remedial action plan summarizes the findings of the risk-based investigation of SAR1 that was conducted in accordance with the *Work Plan for the Demonstration of a Risk-Based Approach to Determine Remedial Requirements at the Former Small Arms Range (SAR1), Travis AFB* (Parsons-ES, 1998).

ESTIMATE OF LEAD ABSORPTION BY THE HUMAN BODY

This estimate was made using the following measurements:

Particle Size – Soil samples were sieved to separate the small soil particles (<250 μm) from the rest of the soil. The lead concentrations were expected to be higher in the larger soil particles (due to the presence of bullet fragments) than in the smaller sieved soil particles. However, the opposite result was found; most of the lead was attached to small soil particles or was in the form of small (<250 μm) particles.

Chemistry – An electron microprobe was used to determine the forms of lead (oxides, sulfates, etc.) that are present in the soil. Different lead compounds are absorbed into people, plants and animals at different rates. The common forms of lead are lead carbonate, iron/lead oxide, lead/other metal oxide, and lead oxide. Lead carbonate tends to have the highest absorption rate.

Lead Absorption Analysis – The study used the USEPA Technical Review Workgroup Adult Blood Lead Mode to evaluate potential risks to on-base industrial workers from site contaminants. This model estimates fetal blood lead concentrations in pregnant women (a

highly sensitive group) from ingested lead-contaminated soil/dust. The study looked at exposure from non-intrusive and intrusive worker activities as well as exposure from beef consumption from cattle allowed to graze at the site.

EVALUATION OF ECOLOGICAL RISK

The study evaluated the potential risks of site contaminants on terrestrial plants and invertebrates, the burrowing owl, the western meadowlark, and the deer mouse. It took into account the disruption of cattle grazing and firebreak disking on the ecological habitat. Once the potential risk was characterized, risk-based remediation goals were calculated.

TREATABILITY TESTING

Three treatment technologies (gravity separation, acid leaching, and stabilization with Portland cement) were tested to determine their effectiveness under existing site conditions.

FEASIBILITY STUDY

A focused feasibility study was performed to evaluate remedial alternatives to reduce risks associated with antimony, copper, and lead concentrations in soil at the site. The five remedial alternatives were land use restrictions, a soil cap, excavation and on-site treatment (acid leaching), excavation and placement in an on-base Corrective Action Management Unit (CAMU), and excavation and off-base disposal.

RESULTS AND CONCLUSIONS

Based on the results of the human health and ecological risk assessments, the study presented the following recommended soil remediation goals that are protective of current and future workers, plants and animals:

Antimony (250 mg/kg), Copper (6 mg/kg), and Lead (1,000 mg/kg)

Gravity separation proved to be ineffective at separating the lead contamination from the local soil. This is primarily due to the high lead concentration in the fine-grain portion of the soil and the difficulty of separating the fine-grain soil from soil with a higher grain size.

Acid leaching using nitric acid was an effective means of removing lead from the soil, attaining an extraction of greater than 90%. Acetic acid was moderately effective at lead removal (59%), which suggests that much of the lead is present in an oxidized form (carbonates and oxides).

Soil samples were stabilized with Portland cement and then underwent leaching tests to determine the effectiveness of the treatment. The test results showed that a cement-to-soil ratio of at least 0.4 was necessary to prepare a physically stable soil.

Based on the assessment of effectiveness, implementability and cost, the study concluded that the preferred remedial alternative is excavation and placement in a CAMU. If the CAMU does not receive regulatory approval, then the preferred remedial alternative is excavation and off-base disposal. Acid leaching was ruled out because of the high costs and difficulty in implementation. The soil cap was ruled out because of the restrictions to future land use that would be needed to allow waste to remain at the site. Land use restrictions were ruled out, because they failed to meet the goals for protecting human health and the environment.